# Sociodemographic and Clinical Status and Its Associations with Disability in Patients with Prediabetes

## Prediyabet Tanılı Hastaların Sosyodemografik ve Klinik Durumları ve Engellilik ile İlişkisi

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**Abstract**

Objective: In this study, we aimed to describe the sociodemographic and clinical status of the patients with prediabetes in an internal medicine outpatient clinic of a tertiary center. **( Sakarya Med J 2019, 9(2):319-325 )**

Materials and Methods: Participants included in this study were chosen among patients who applied to Kayseri City Hospital between June 2018 and December 2018. Inclusion criteria for participants were aged between 18-65 and blood glucose levels in prediabetic range (n=96). Participants' age, gender, marital status, salary, education, profession, employment, smoking status, alcohol use, height, weight, body mass index, insulin resistance were based on self-report and our measurements.

Results: Half of the patients with prediabetes was in IFG (n=50) and the subgroup with fewest patients was IGT (n=14) in our study also. Combined group (IFG + IGT) was higher (n=32). Seventy-one of the patients were female (74%). Twenty-three patients smoked at anytime and mean pack-years was 27.78 (min:1, max:95, sd: 23.55), 93 patients (96.7%) never used alcohol. Fifteen patients were retired, and disablement was the cause of only one of them. The ratio of insulin-resistant patients was 50%. Marital status of patients was one single, 89 married, five widows/widower, one divorced. There was a higher rate of obesity in prediabetic patients in our study. Ratio of BMI according to cut-off points was 1%, 9%, 18%, 68.76% for ≤ 18.5 kg/m2; 18.6-24.9 kg/m2; 18 % 25.0-29.9 kg/m2; 68.76 % ≥30 kg/m2, respectively. Median and mean HAQ-DI scores were 0.125 (IQR: 0-0.625) and 0.384 (SD:0.534) respectively. 67 patients (69.9%) did not have any disability (HAQ-DI score was 0-0.375).

Conclusion: Prediabetes is an increasingly common disease, leading to severe morbidities. Most patients are obese and female. Most female patients of prediabetic patients were housewives. Early diagnosis and appropriate treatment of people with these characteristics, especially those with a high risk of prediabetes, can prevent the development of diabetes.

Keywords: disability; prediabetes; sociodemographic

**Öz**

*Amaç: Bu çalışmada 3. basamak iç hastalıkları polikliniğine başvuran prediyabetik hastalarda sosyodemografik ve klinik verileri tanımlamayı ve engellilik ile ilişkisini araştırmayı amaçladık. **( Sakarya Tip Dergisi 2019, 9(2):319-325 )**.*

*Gereç ve Yöntemler: Kayseri Şehir Hastanesi İç Hastalıkları polikliniğine Haziran-Aralık 2018 tarihleri arasında başvuran ve prediyabet tanısı alan, 18-65 yaş arası hastalar çalışmaya alındı (n=96). Hastaların yaşı, cinsiyeti, evlilik durumu, maaşı, eğitim durumu, işi, emeklilik durumu, sigara ve alkol kullanım durumu, boy, kilo ve vücut kitle indeksi (VKİ), insulin direnci varlığı kaydedildi.*

*Bulgular: Prediyabetik hastaların yarısında (n=50) bozulmuş açlık glukozu (BAG) mevcutken 14 hastada bozulmuş glukoz toleransı (BGT) vardı. Diğer hastalarda ise hem BAG hem de BGT vardı (n=32). Hastaların 71'i (74%) kadındı. Yirmi üç hasta sigara içiyordu ve ortalama 27.78 (ss: 23.55) paket-yıl sigara kullanmışlardı. Doksan üç hasta (96.7%) hiç alkol almamıştı. On beş hasta emekli iken, içlerinden sadece biri maluliyet nedeniyleydi. Hastaların yarısında insulin direnci vardı. Bir hasta bekar, beş hasta dul, bir hasta boşanmış ve diğer hastalar evliydi. VKİ'ye göre obezite durumu sırasıyla VKİ≤ 18.5 kg/m2 %1 hasta; VKİ = 18.6-24.9 kg/m2 %9 hasta; VKİ=25.0-29.9 kg/m2 %18 hasta; VKİ≥30 kg/m2 %68.76 hasta idi. Ortanca ve ortalama HAQ-DI skorları sırasıyla 0.125 (IQR: 0-0.625) ve 0.384 (SD:0.534) idi. 67 (69.9%) hastada engellilik durumu yoktu (HAQ-DI skoru 0-0.375 idi).*

*Sonuç: Prediyabet gittikçe artan sıklıkta görülen yaygın bir hastalık olup ciddi morbidite sebebi olabilir. Hastaların çoğunluğu kadın ve obezdir. Kadın prediyabetik hastaların da çoğu ev hanımı idi. Bu hastalarda erken tanı ve uygun tedavi ile ciddi bir halk sağlığı sorunu olan, aynı zamanda engellilik, ciddi morbidite ve mortalite sebebi de olan diyabetin gelişmesinden korunulabilir.*

*Anahtar Kelimeler: engellilik; prediyabet; sosyodemografik durum*

## INTRODUCTION

Prediabetes (PD) comprises impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), which occurs when blood glucose levels are higher than awarage but below the threshold of diabetes.[1] In etiology of prediabetes, insulin resistance and β cell dysfunction play a key role like diabetes.[2] According to the American Diabetes Association, IGT is defined as a 2-hour plasma glucose value of 140 to 199 mg/dL (7.8 to 11.0 mmol/L) and IFG as a fasting plasma glucose value of 100 to 125 mg/dL (5.6 to 6.9 mmol/L) ) in the 75-g oral glucose tolerance test (OGTT). PD can also be defined as a hemoglobin A1c (HbA1c) value of 5.7% to 6.4% (39–46 mmol/mol).[3]

In adults, the prevalence of PD is 38% in the USA[4] and 35.7% in China.[5] Worldwide, there are more than 400 million people with PD and it is estimated that more than 470 million people will have PD by 2030.[6] Risk factors for development of PD are genetic factors, stress, drugs, middle age, a history of gestational diabetes, obesity, physical inactivity, nutrition such as high total caloric intake and low fiber diet, which are similar with the type 2 diabetes mellitus (T2DM).[7] Also, PD is a risk factor for cardiovascular disease, fatty liver, renal, ophthalmic and neuropathic disease, cognitive dysfunction and cancer, just like T2DM.[8]

Diabetic patients have a higher prevalence of disability than people without diabetes (age-standardized rates of 39% compared with 17%) and are also more likely to have a severe or profound limitation comparing to people without diabetes (age-standardized rates of 14% compared with 5%).[9] There is not enough data about disability in PD. PD is a severe and essential disease which may cause morbidity and there is not enough study describing sociodemographic, clinical data, and disability status of patients with PD. In this study, we firstly aimed to describe the sociodemographic and clinical status, secondly disability of the patients with PD in an internal medicine outpatient clinic of a tertiary center.

## MATERIAL and METHODS

### Participants

A descriptive, cross-sectional study was conducted among patients who applied to Kayseri City Hospital between June 2018 and December 2018. Inclusion criteria for participants were aged between 18-65 and blood glucose levels in prediabetic range (n=96). Participants age, gender, marital status, salary, education, profession, and employment were based on self-report. Marital status was categorized as single (never married), married, and widowed and divorced. Wage status was determined according to the minimum wage. Education level was classified as illiteracy, literacy, primary school, high school, and university. The profession was categorized as a housewife, worker, professional, retired, and employment was categorized as disability, retired, working.

### Smoking Status and Alcohol Use

Smoking status (current, former, or never smoker) and alcohol use (yes or never) were measured by self-report.

### Health indicators

Self-rated health was measured on a 5-point scale that ranged from poor to excellent. Height and weight were measured by a nurse and used to calculate body mass index (BMI), weight in kilograms divided by height in meters squared. BMI was then categorized as underweight (below 18.6 kg/m2), normal (18.6-25 kg/m2), overweight (25-29.9 kg/m2), obese (30-39.9 kg/m2) and morbid obese (40 kg/m2 and above).[10]

### Health Assessment Questionnaire-Disability Index (HAQ-DI)

There are eight sections in this questionnaire: dressing, arising, eating, walking, hygiene, reach, grip, and activities, and in each section, there are 2 or 3 questions. Scoring within each question is from 0 (without any difficulty) to 3 (unable to do). For each section, the score given to that section is the worst score within the section, i.e., if one question is scored 1 and another 2, then the score for the

section is . Also, if an aide or device is used or if help is required from another individual, then the minimum score for that section is 2. If the section score is already 2 or more, then no modification is made. The eight scores of the eight sections are summed and divided by [8]. The result is the HAQ-DI score.[11] The validity and reliability of the Turkish version of the HAQ-DI have been proven.[12] In the present study respondents with a DI lower than 0.50 were considered not disabled. A DI from 0.50 to 1.00 was considered as mild disability while a DI of 1.00 or higher was regarded as severe disability.[13]

### Insulin resistance measurement

12-hour fasting blood samples were obtained for fasting plasma insulin (FPI) and fasting plasma glucose (FPG) measurements in order to calculate the homeostasis model assessment of insulin resistance (HOMA-IR). It was determined by the formula[14]:

HOMA-IR = FPI (mU/L) x FPG (mmol/L) / 22.5.
If the result is ≥ 2.5, insulin resistance is positive.

### Statistical Analysis:

For statistical analyses, SPSS 22.0 (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.) program was used. All continuous variables were expressed in minimum-maximum; standard deviation unit, while frequencies were expressed in percentage (%). Relationships between parameters were analyzed by Spearman rank correlation coefficients (ICCs).

Ethical Issues: Local ethical committee approval was received for this study from Erciyes University Ethical committee. All patients were informed about the study protocol and gave their written informed consents.

### Financial Support:

None.

## RESULTS

Ninety-six newly diagnosed patients with PD, who admitted to our internal medicine outpatient clinic, were recruited consecutively. Seventy-one of them were female. Twenty-three patients smoked at any time and mean pack-years was 27.78 (min:1, max:95, sd:23.55), 93 patients (96.7%) never used alcohol. Fifteen patients were retired, and disablement was the cause of only one retirement. Other socio-demographic data were shown in Table 1. and clinical data in Table 2.

**Table 1. Socio-demographic data of patients with prediabetes; n: 96**

| | |
|---|---|
| Age, years; mean (min.-max.; sd) | 51.64 (24-78; 12.06) |
| Gender; female/male (%) | 71/25 (74/26) |
| Marital status; n (%) | |
| Single | 1 (1) |
| Married | 89 (92.7) |
| Widow/widower | 5 (5.2) |
| Divorced | 1 (1) |
| Educational status; n (%) | |
| Illiteracy | 4 (4.2) |
| Literacy | 6 (6.3) |
| Primary school | 67 (69.8) |
| High school | 10 (10.4) |
| University | 8 (8.3) |
| Profession; n (%) | |
| Housewife | 67 (69.8) |
| Worker | 6 (6.3) |
| Professional | 8 (8.3) |
| Retired | 15 (15.6) |
| Employment; n (%) | |
| Disability and retired | 1(1) |
| Retired | 14 (15.6) |
| Working | 81 (84.3) |
| Salary, TL; mean (min.-max.; sd) | 2291.38 (1600-5000; 809.88) |
| Salary status; n (%) | |
| Minimum wage | 6 (6.3) |
| < 2 x min. wage | 20 (20.8) |
| ≥ 2 x min. wage | 3 (3.1) |
| Smoking status; n (%) | |
| Never | 72 (75) |
| Former | 12 (12.5) |
| Current | 11 (11.5 |

| **Table 2. Clinical data of patients with prediabetes ; n: 96** | |
|---|---|
| **BMI, kg/m2 ; mean (min.-max.; sd)** | 34.15 (18.40-59.37; 7.29) |
| **Weight classification; n (%)** | 71/25 (74/26) |
| **Weak (BMI ≤ 18.6)** | 1 (1) |
| **Normal (BMI: 18.6-24.9)** | 9 (9.4) |
| **Over weight (BMI: 25-29.9)** | 18 (18.8) |
| **Obese (BMI: 30-39.9)** | 46 (47.9) |
| **Morbid obese (BMI ≥ 40)** | 20 (20.8) |
| **HOMA-IR; mean (min.-max.; sd)** | 3.38 (0.79-19.51; 2.75) |
| **OGTT 0. minute; mg/dl; mean (min.-max.; sd)** | 107.11 (85-125; 8.09) |
| **OGTT 2nd hour; mg/dl; mean (min.-max.; sd)** | 138.71 (65-199; 33.92) |
| **HbA1C; mean (min.-max.; sd)** | 5.90 (5-6.5; 0.37) |
| **IFG; n (%)**<br>**IGT; n (%)**<br>**IFG + IGT; n (%)** | 50 (52.1)<br>14 (14.6)<br>32 (33.3) |
| **Insulin resistant patients, n (%)** | 48 (50) |
| BMI: body mass index; FPG: fasting plasma glucose; OGTT: oral glucose tolerance test; IFG: impaired fasting glucose; IGT: impaired glucose tolerance; HOMA-IR: homeostasis model assessment of insulin resistance | |

Median and mean HAQ-DI scores were 0.125 (IQR: 0-0.625) and 0.384 (SD:0.534) respectively. 67 patients (69.9%) did not have any disability (HAQ-DI score was 0-0.375). Other patients HAQ-DI scores were between 0.5 - 0.875: 8 patients (8.3%), 1.0 - 2.0: 11 patients (11.3%). Only one patient's HAQ-DI score was more than 2 (2.25). HAQ-DI scores and its associations were summarized in Table 3.

| **Table 3. HAQ-DI score and correlations with clinical data of patients with prediabetes** | | |
|---|---|---|
| | Rho value | P value |
| BMI | 0.358 | <0.001 |
| OGTT-0. min. | -0.189 | 0.072 |
| OGTT-2. hour | 0.018 | 0.864 |
| HbA1C | 0.123 | 0.286 |
| HOMA-IR | 0.118 | 0.257 |
| IR (+)ve | 0.143 | 0.152 |
| BMI: body mass index; OGTT: oral glucose tolerance test; HOMA-IR: homeostasis model assessment of insulin resistance | | |

## DISCUSSION

The objective of the present study is to find the sociodemographic and clinical aspects of PD among Turkish people in Kayseri City Hospital, which is located in central Anatolia (also called Cappadocia region in which diabetes was first described and named by Arateus 2000 years ago). Kayseri City Hospital, which serves to approximately 3 million people, is one of the largest hospitals in Turkey. Each month, more than 5000 patients with diabetes mellitus are treated in our center. This hospital in which our study was conducted, is a very significant center for the prevention of diabetes where all diabetic complications can be treated. Because of the geographical settling, Turkish people are influenced by near-East Asia and European civilization in terms of social, economic, genetic, and socio-cultural views. In addition to regional genetic predisposition, carbohydrate-weighted diet and sedentary lifestyle are the most important risk factors for PD.[7] By the 21st century, urbanization and economic development caused radical changes in the lifestyle. In terms of regional dietary tendencies and job opportunities, Kayseri and its surroundings are at great risk for PD.

The first epidemiological study, in which demographic data was provided for diabetes and PD, was performed by Kelestimur et al. in Turkey.[15] There are 130 patients both with IGT and IFG. Our study contains 46 male (35%) and 84 female (65%), mean age was 51.32 ± 11.97 years and mean BMI was 30.02 ± 4.86 kg/m2. In both studies, both PD and obesity were also more common in women comparing to men. In our study, the mean age of patients (51.64 ± 12.06) was similar to the study of Kelestimur et al., but mean BMI (34.15 ± 7.29) was higher. It may associate with increased obesity over the years in the whole population.[16,17] In approximately 20 years, a number of obese patients with PD are about to rise to the level of morbid obesity. In relation to this, the ratio of PD to female/male increased approximately from 2/1 to 3/1. The increasing trend in age among people with PD is consistent with previous literature.[18,19] Potential explanations for differences of diabetes development between men and women have

been described, such as the differential effect of body size, gender differences in the heritability of T2DM, and gender differences in FPG levels.[20,21] This interaction may also be effective in the development of PD.

Risk factors of diabetes and PD among Turkish adults are examined in the latest and largest prevalence study, which was a population-based study of over 26499 adults in Turkey.17 Satman et al. reported that the crude prevalence of PD was 30.8% (isolated-IFG 14.7%, isolated-IGT 7.9%, and combined 8.2%) in 2013. Similarly, half of the patients with PD was IFG, and the smallest subgroup was IGT in our study also. Unlike the combined group (IGT + IFG) was higher (33.3%). Insulin resistance is increased in PD as compared to those with normal glucose tolerance.[22] In our study, the rate of insulin-resistant patients was high (50%) in accordance with the literature. There was even reports with higher rates in the literature, such as 72% of 127 patients with PD who were followed-up by Ariel et al. were insulin resistant.[23]

The rate of retirement in diabetic patients is high and this rate is around 50%.[24] In our study, 15 patients were retired, and only one of them was caused by disablement. The lower prevalence of retirement in people with PD compared to diabetes is compatible with the literature.[18,25] This may be due to fewer complications in prediabetic patients than diabetic patients.[8]

Active or passive smoking is independently associated with PD, diabetes, and insulin resistance.[26,27,28] Prevalence of smoking varies according to gender, income, occupation, and education status.[29] In Su et al.'s study, the prevalence of current smoking was 45.5% in male patients with T2DM.[30] In a study of PD, the rate of current smokers was 24%, while ex-smokers were 41%.18 The smokers in the Turkish population were 31.4 %, while the ex-smokers were 25.1%. In women, this rate was 9.8% and 5.2%, respectively.16 Whereas the rate of people who never smoked was 75%, only 11.5 % of the patients with PD were in a subgroup of current smoker in our study. Also, only 5 of the 67 housewives were current smokers. This may be related to the high prevalence of housewives (69.8%) in our study. 92.7 % of the patients were married in our study. This rate was higher than the marriage rate of 893 prediabetic patients (73.3%) in the UK study.[18] In that study, the rate of divorce in patients with PD was relatively high (10.7%). In our study, only 1 participant was divorced. Its singularity ratio was higher than we found (respectively; 4.4%, 1%).

In Iran, there had been a study on PD in 2017, which is similar to our sociodemographic data.31 In that study conducted by Amiri et al., there were 1313 prediabetes patients. BMI was divided into four categories and the percentages were as follows compared to ours. BMI of adults from Tehran and Kayseri adults were respectively 0.15%, 1% (≤18.5 kg/m2); 17.2 %, 9% (18.6-24.9 kg/m2); 44.4 %, 18% (25.0-29.9 kg/m2); 38.2%, 68.76% (≥30 kg/m2). There is a higher rate of obesity among prediabetic patients in Kayseri, even more than Tehran, which is a great metropolis. According to a study conducted in Konya, which is located closely to Kayseri and similar in terms of sociocultural and dietary conditions, 676 housewives were selected by cluster sampling method. The prevalence of obesity in women was 33.9% in that study.[32] Atherosclerotic risk factors were determined by systematic sampling method in Kayseri population. There were 1130 participants aged 30 years and over, and the prevalence of obesity in Kayseri was 50.6 % in women and 20.2 % in men.[33] The high prevalence in obesity must be associated with this region. In our opinion, Kayseri and its surroundings are under red alert for obesity and PD which are the predators of many diseases.

It is known that diabetic patients have a higher prevalence of disability, primarily associated with microvascular and macrovascular complications.[9] And there is limited data of disability in PD. In our study, we found that most of the patients with PD didn't have a disability which was not associated with PD-related laboratory findings including

OGTT values, HbA1c value, and HOMA-IR. Only BMI was weakly positively correlated with disability in PD. The prevalence of microvascular and macrovascular complications is lower in PD comparing to diabetes, so PD may be a 'window of opportunity' to prevent patients from disability.

In conclusion, PD is an increasingly common disease, leading to severe morbidities. Most female patients of prediabetic patients were housewives. Most patients were obese and had low levels of education. Some patients had a disability. Early diagnosis and appropriate treatment of people with these characteristics, especially those with high risk of prediabetes, can prevent the development of diabetes, which is a frequent public health problem and a cause of disability, severe morbidity and mortality.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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